U.S. DEPARTMENT OF ENERGY
DEPARTMENT-WIDE
FUNCTIONAL AREA QUALIFICATION STANDARD

CONSTRUCTION MANAGEMENT AND ENGINEERING QUALIFICATION STANDARD

Defense Nuclear Facilities Technical Personnel

U.S. Department of Energy
Washington, D.C. 20585

May 1995

Approval and Concurrence

The Associate Deputy Secretary for Field Management is the Management Sponsor for the Department-wide Construction Management and Engineering Functional Area Qualification Standard. The Management Sponsor is responsible for reviewing the Qualification Standard to ensure that the technical content is accurate and adequate for Department-wide application. The Management Sponsor, in coordination with the Human Resources organization, is also responsible for ensuring that the Qualification Standard is maintained current. Concurrence with this Qualification Standard by the Associate Deputy Secretary for Field Management is indicated by the signature below.

The Technical Personnel Program Coordinator (TPPC) is responsible for coordinating the consistent development and implementation of the Technical Qualification Program throughout the Department of Energy. Concurrence with this Qualification Standard by the Technical Personnel Program Coordinator is indicated by the signature below.

The Technical Excellence Executive Committee (TEEC) consists of senior Department of Energy managers. This Committee is responsible for reviewing and approving the Qualification Standard for Department-wide application. Approval of this Qualification Standard by the Technical Excellence Executive Committee is indicated by the signature below.

NOTE: **The signatures below reflect concurrence and approval of this Qualification Standard for interim Implementation. Final concurrence and approval will occur in December 1995, pending comments received based upon implementation.**

CONCURRENCE:

_____	_____
Associate Deputy Secretary for Field Management	Technical Personnel Program Coordinator

APPROVAL:

_____

Chairman
Technical Excellence Executive Committee

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U.S. DEPARTMENT OF ENERGY
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FUNCTIONAL AREA

Construction Management and Engineering

PURPOSE

The Technical Qualification Program is divided into three levels of technical competence and qualification. The General Technical Base Qualification Standard establishes the base technical competence required of all Department of Energy defense nuclear facility technical personnel. The Functional Area Qualification Standards build on the requirements of the General Technical Base Qualification Standard and establish Department-wide functional competence requirements in each of the identified functional areas. Office/facility-specific qualification standards establish unique operational competency requirements at the Headquarters or Field element, site, or facility level.

The Construction Management and Engineering Functional Area Qualification Standard establishes common functional area competency requirements for all Department of Energy construction management and engineering personnel who provide management oversight or direction impacting the safe operation of defense nuclear facilities. Satisfactory and documented completion of the competency requirements contained in this Standard ensures that technical employees possess the minimum requisite competence to fulfill their functional area duties and responsibilities. Additionally, these competency requirements provide the functional foundation to assure successful completion of the appropriate Office/facility-specific qualification standard.

APPLICABILITY

This Standard applies to all Department of Energy construction management and engineering technical personnel who provide management direction or oversight impacting the safe operation of defense nuclear facilities. Personnel designated by Headquarters or Field element line management as participants in the Technical Qualification Program are required to meet the requirements of this Standard as defined in DOE Order 3410, Training.

IMPLEMENTATION REQUIREMENTS

The competencies contained in the Standard are divided into the following four categories:

1. General Technical
2. Regulatory
3. Administrative
4. Management, Assessment, and Oversight

Each of the categories is defined by one or more competency statements indicated by bold print. The competency statements define the expected knowledge and/or skill that an individual must

possess, and are requirements. Each competency statement is further explained by a listing of supporting knowledge and/or skill statements. The supporting knowledge and/or skill statements are not requirements and do not necessarily have to be fulfilled to meet the intent of the competency.

The competencies identify a familiarity level, working level, or expert level of knowledge; or they require the individual to demonstrate the ability to perform a task or activity. These levels are defined as follows:

> **Familiarity level** is defined as basic knowledge of or exposure to the subject or process adequate to discuss the subject or process with individuals of greater knowledge.
>
> **Working level** is defined as the knowledge required to monitor and assess operations/activities, to apply standards of acceptable performance, and to reference appropriate materials and/or expert advice as required to ensure the safety of Departmental activities.
>
> **Expert level** is defined as a comprehensive, intensive knowledge of the subject or process sufficient to provide advice in the absence of procedural guidance.
>
> **Demonstrate the ability** is defined as the actual performance of a task or activity in accordance with policy, procedures, guidelines, and/or accepted industry or Department practices.

Headquarters and Field elements shall establish a program and process to ensure that all defense nuclear facility technical personnel required to participate in the Technical Qualification Program meet the competency requirements contained in this Standard. Documentation of the completion of the requirements of this Standard shall be included in the employee's training and qualification record.

In select cases, it may be necessary to exempt an individual from completing one or more of the competencies in this Functional Area Qualification Standard. Exemptions from individual competencies shall be justified and documented in accordance with DOE Order 3410, Training. Exemptions shall be requested by the individual's immediate supervisor, and approved one level above the individual's immediate supervisor.

Equivalencies may be granted for individual competencies based upon an objective evaluation of the employee's prior education, experience, and/or training. Documentation of equivalencies shall indicate how the competency requirements have been met. The supporting knowledge and/or skill statements may be considered when evaluating an individual's ability with respect to each competency requirement.

Training shall be provided to employees in the Technical Qualification Program who do not meet the competencies contained in the qualification standard. Departmental training will be based upon supporting knowledge and/or skill statements similar to the ones listed for each of the competency statements. Headquarters and Field elements should use the supporting knowledge and/or skill statements as a basis for evaluating the content of any training courses used to provide individuals with the requisite knowledge and/or skill required to meet the qualification standard competency statements.

DUTIES AND RESPONSIBILITIES

The following are duties and responsibilities normally expected of defense nuclear facility technical personnel assigned to the construction management and engineering functional area:

A. Ensures that construction projects comply with, or are completed in accordance with, DOE Orders, Federal, state, local, and industry standards.

B. Reviews, evaluates, and monitors planning, budgets, costs, and schedules in accordance with authorized baseline and contracts.

C. Manages construction activity in accordance with approved project documents, established engineering practices, and construction industry standards.

D. Provides on-site presence for the evaluation of field construction activities and evaluates contractor performance using surveillance, audits, and inspections.

E. Performs review of design and construction documents to ensure project constructibility.

F. Ensures compliance with environmental safety and health, quality assurance, and Occupational Safety and Health Act requirements.

G. Conducts construction project management briefings and prepares reports to reflect project status, cost and schedule trends, work force adequacy, funding, and project uncertainties.

H. Ensures that accurate and timely project documentation is maintained over the construction project life cycle (configuration management implementation).

I. Participates in the annual budget process for construction projects.

J. Participates in Department and industry conferences and symposia related to maintaining job proficiency.

Additional duties and responsibilities specific to the site, facility, operational activities, and/or other involved organizations shall be contained in the facility-specific qualification standard(s).

BACKGROUND AND EXPERIENCE

The U.S. Office of Personnel Management's Qualification Standards Handbook establishes minimum education, training, experience, or other relevant requirements applicable to a particular occupational series/grade level, as well as alternatives to meeting specified requirements.

The preferred education and experience for construction management and engineering personnel is:

1. Education:

   Bachelor of Science degree in Civil, Mechanical, Nuclear, Chemical, or Electrical Engineering; or meet the alternative requirements specified in the Qualifications Standards Handbook.

2. Experience:

   Industrial, military, Federal, state or other directly related background that has provided specialized experience in construction management and engineering. Specialized experience may be demonstrated through possession of the competencies outlined in this Standard.

3. Certification:

   Registered as a professional engineer in any state or jurisdiction.

REQUIRED COMPETENCIES

The competencies contained in this Standard are distinct from those competencies contained in the General Technical Base Qualification Standard. All construction management and engineering personnel must complete the competency requirements of the General Technical Base Qualification Standard prior to or in parallel with the completion of the competency requirements contained in this Standard. Each of the competency statements defines the level of expected knowledge and/or skill that an individual is required to possess to meet the intent of this Standard. The supporting knowledge and/or skill statements further describe the intent of the competency statements but are not requirements.

1. GENERAL TECHNICAL

1.1 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of the techniques, equipment, and documentation of surveys.

Supporting Knowledge and/or Skills

a. Discuss the mathematical basis for horizontal and vertical control.

b. Discuss the different types of surveying equipment commonly used on a construction project including their applications and limitations.

c. Describe the methods for verifying proper survey equipment calibration.

d. Discuss the care and handling of survey equipment.

e. Describe standard practices for preparing survey field notes.

f. Discuss the appropriate state requirements for preparing survey documentation, drawings, site plans, profiles, and contours.

g. Read and interpret survey field notes.

h. Define and discuss error closure as it applies to surveying.

1.2 Construction management and engineering personnel shall demonstrate the ability to establish other control points from a set of horizontal and vertical control points.

Supporting Knowledge and/or Skills

a. Select the proper instruments for establishing control points.

b. Discuss the procedure for measuring angles and distances.

c. Determine the proper route using known points.

d. Estimate turning points.

e. Define and discuss the following terms associated with control points:

- Benchmark
- Back-site
- Temporary benchmark
- Turning point
- Latitudes
- Departures
- Instrument height
- Bearings
- Grid coordinates

1.3 Construction management and engineering personnel shall demonstrate a working level knowledge of the principles and construction methods associated with grading, paving, and drainage for site preparation.

Supporting Knowledge and/or Skills

a. Read and interpret a site plan drawing.

b. Read and interpret a contour map.

c. Draw a site contour map from field notes and survey data.

d. Develop cross sections.

e. Use mathematical techniques to determine earth quantities.

f. Discuss field and lab soil compaction methodologies and utilization criteria.

g. Define the following terms as they relate to horizontal curves:

- Point of intersection (PI)
- Point of tangency (PT)
- Point of curvature (PC)

h. Prepare a site grading plan.

i. Define, compare, and contrast the following terms:

- Balance and cut-and-fill
- Shrink and swell

j. Discuss the characteristics of rigid and flexible pavement.

k. Discuss the hydraulics associated with drainage to include:

- Open channel flow
- Flood zone determination

l. Discuss the following elements of hydrostatics related to site preparation:

- Hydrostatic pressure
- Flood routing
- Hydraulic gradient
- Seepage

m. Discuss the construction methods and requirements associated with earth work and trenching. Include the following elements in the discussion:

- Water pollution and soil erosion
- Noise pollution
- Traffic control measures
- Dust control

1.4 Construction management and engineering personnel shall demonstrate a working level knowledge of techniques for preparing cost estimates.

Supporting Knowledge and/or Skills

a. Discuss how each of the following factors contributes to the development of cost estimates for a construction project:

- Construction plans
- Productivity rates
- Specifications
- Crew composition
- Schedule interpretation and impacts
- General and administrative rates
- Material prices
- Equipment types and rates
- Known labor rates

b. Discuss the impact of job factors on productivity rates.

c. Develop time, material, and labor estimates for a construction project.

d. Discuss the effect of escalation and inflation factors on cost estimates.

e. Discuss the purpose of contingency in cost estimating, including an explanation of how it is calculated.

f. Prepare a cost and technical analysis of a contractor's proposal.

g. Discuss funding authorization limits and their impact on the cost estimating process.

h. Develop recommendations for the contracting officer based on cost and technical analysis.

i. Describe the application and use of estimator tools.

1.5 Construction management and engineering personnel shall demonstrate a working level knowledge of techniques for scheduling construction projects.

Supporting Knowledge and/or Skills

a. Discuss construction project scheduling methods, including an explanation of critical path scheduling.

b. Discuss each of the following elements of construction project scheduling, including the factors of each that could impact the schedule:

- Orderly delivery of equipment and materials in sequence with the installation schedule
- Construction equipment requirements
- Manpower planning and scheduling
- Bidding and award activities

c. Read, interpret, and develop the following construction project control aids:

- GANTT Charts (bar chart)
- Networking techniques (critical path method)
- Percentage completion curve (S curve)
- Labor schedules
- Material schedules
- Equipment schedules
- Finance schedules

d. Prepare and control project baseline using resource loaded, time based CPM schedules at a level and frequency that potential problems can be identified and solved before they become real problems.

1.6 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of contract law applicable to contract specifications and drawings.

Supporting Knowledge and/or Skills

a. Discuss stop-work orders including responsibilities and authorities, and the impact of a stop-work order to project cost and schedule.

b. Describe what constitutes compliance with specifications and drawings.

c. Discuss the process for making changes and modifications to contract specifications or the scope of work.

d. Describe the difference between expressed and implied warranties and how each is addressed in contract specifications.

e. Describe the process for expending funds for a project as it relates to contract law.

f. Describe in general terms the process used to negotiate and establish a construction contract between the Department of Energy and the contractor.

1.7 Construction management and engineering personnel shall demonstrate the ability to read and interpret engineering piping and instrument drawings (P&ID).

Supporting Knowledge and/or Skills

a. Identify the symbols used on engineering piping and instrument drawings for:

- Types of valves
- Types of valve operators
- Basic types of instrumentation
- Types of system components (pumps, etc.)
- Types of lines

b. Identify the symbols used on engineering piping and instrument drawings to denote the location of instruments, indicators, and controllers.

c. Identify how valve conditions are shown on a piping and instrument drawing.

d. Determine the system flowpath for a given valve lineup.

1.8 Construction management and engineering personnel shall demonstrate the ability to read and interpret electrical diagrams and schematics.

Supporting Knowledge and/or Skills

a. Identify the symbols used on electrical engineering drawings.

b. Identify the symbols and/or codes used on electrical engineering drawings to show the relationship between components.

c. State the condition in which all electrical devices are shown, unless otherwise noted on the diagram or schematic.

d. Given a simple electrical schematic and initial conditions, identify the power sources and/or loads and their status.

1.9 Construction management and engineering personnel shall demonstrate the ability to read and interpret electronic block diagrams and logic diagrams.

Supporting Knowledge and/or Skills

a. Given an electronic block diagram, print, or schematic, identify the symbols that represent the basic components.

b. Identify the symbols on logic diagrams that represent the components.

c. Given a logic diagram and appropriate information, determine the output of each component and the logic circuit.

1.10 Construction management and engineering personnel shall demonstrate the ability to read and interpret engineering fabrication, construction, and architectural drawings.

Supporting Knowledge and/or Skills

a. Given the above drawings, read and interpret the following symbology:

- Basic dimensional and tolerance
- Basic fabrication
- Basic construction
- Basic architecture

b. Given a drawing and a completed or partially completed product, compare the product against the specifications on the drawing.

c. Discuss the relationship between specifications and drawings.

d. Describe the process for resolving conflicts between specifications and drawings.

1.11 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of the principles and concepts of natural phenomena hazards.

Supporting Knowledge and/or Skills

a. Discuss the impact on facilities, and the mitigating factors, associated with the following hazards:

- Flooding
- Wind
- Tornado
- Earthquake and/or other seismic events

b. Describe the safety measures and design features commonly used as safeguards against natural hazards.

c. Discuss the requirements related to earthquake load design that are stipulated in DOE Order 6430.1A, General Design Criteria, for Department of Energy facilities that handle, process, or store radioactive material.

1.12 Construction management and engineering personnel shall demonstrate a working level knowledge of fire protection requirements for a construction site.

Supporting Knowledge and/or Skills

a. Discuss the fire protection requirements and precautions for material storage on a construction site.

b. Discuss the fire protection safety requirements for egress from areas of a construction site.

c. Discuss the availability and location of fire fighting equipment requirements on a construction site.

d. Discuss the fire protection considerations specific to a construction activity that could affect nuclear safety at a defense nuclear facility.

e. Perform construction site safety inspections of fire protection capabilities and equipment.

f. Discuss the contractor's responsibility for fire protection during construction activities at a defense nuclear facility.

1.13 Construction management and engineering personnel shall demonstrate a working level knowledge of construction methods and accepted construction practices for the following:

- **Structural waterproofing**
- **Architectural finishes**
- **Roofing systems**
- **Mechanical and electrical equipment installation**
- **Material protection and storage**
- **Construction site tools, equipment, and materials**

Supporting Knowledge and/or Skills

a. Discuss the requirements, materials, and methods for waterproofing walls, floors, or other building elements that are subject to hydrostatic pressure, are below the water table, or may be immersed in water.

b. Discuss the construction methods and requirements associated with the following architectural finishes. Include the elements of fire protection, hazardous material contamination, and indoor air quality in the discussion.

   - Lath and plaster
   - Gypsum board
   - Tile
   - Acoustical treatment
   - Resilient flooring
   - Carpet
   - Resinous flooring
   - Conductive flooring
   - Paint
   - Wall coverings
   - Special coatings

c. Discuss the construction methods and requirements of roofing systems. Include the following elements in the discussion:

   - Roofing tiles
   - Membrane roofing
   - Bituminous roofing
   - Sheet metal roofing
   - Single ply roofing
   - Roof mounted equipment
   - Water retention

d. Discuss the construction methods and requirements for installing electrical and mechanical equipment. Include the following elements in the discussion:

- Clearances
- Maintenance access and staging space
- Spill consequences
- Accessibility to cranes and hoists
- Bonding and grounding of equipment

e. Discuss the methods and requirements for material protection and storage on the construction site. Include the following elements in the discussion:

- Theft protection
- Moisture protection
- Temperature protection

f. Describe the use and application of various tools and equipment used on a construction project. Include a discussion of specialty tools used for specific applications.

g. Discuss the characteristics, material strength properties, and service applications for the materials used on a construction project. Include the following elements in the discussion:

- Sand and aggregate
- Construction lumber
- Concrete
- Back-fill material
- Shoring

1.14 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of the chemical fundamentals of corrosion.

Supporting Knowledge and/or Skills

a. Explain the general corrosion process for iron and steel when exposed to water.

b. Discuss the conditions that can cause galvanic corrosion.

c. Discuss the following types of specialized corrosion:

- Pitting corrosion
- Stress corrosion cracking
- Crevice corrosion

1.15 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of chemical safety fundamentals.

Supporting Knowledge and/or Skills

a. Discuss the hazards associated with the use of corrosives (acids and alkalies).

b. Describe the general safety precautions to be taken during the handling, storage, and disposal of corrosives.

c. Discuss the general safety precautions to be taken during the use, handling, and storage of compressed gases, specifically including: hydrogen, oxygen, and nitrogen.

d. Discuss the safety precautions for working with cryogenic liquids.

e. Explain the difference between an inflammable material and a combustible material.

f. Describe the general safety precautions to be taken during the use, handling, and storage of inflammable and combustible materials.

g. Describe the information on a material safety data sheet (MSDS) and discuss the uses for material safety data sheets on a construction project.

1.16 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of the basic principles and concepts of geoscience as applied to soil, erosion, foundations, and earth embankments.

Supporting Knowledge and/or Skills

a. Identify and describe examples of shallow and deep foundations.

b. Discuss the basic elements of embankment design.

c. Define erosion and describe the characteristics and effects of water and wind erosion.

d. Describe the types of tests used to determine the strength and dynamic properties of soils.

e. Describe the unified soil classification system.

f. Discuss the applicability of active, passive, and at-rest pressures to earth retaining structures.

1.17 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of the basic concepts of hydrology.

Supporting Knowledge and/or Skills

a. Define hydrology as it applies to construction management and engineering.

b. Describe the flow of subsurface groundwater.

1.18 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of the Department of Energy's design and construction processes.

Supporting Knowledge and/or Skills

a. Discuss the following elements of the Department design process:

- Congressional project approval process
- Actual preparation of a conceptual design report
- Architect/engineer selection process
- Design approval process

b. Discuss the Department's construction process following a project's certification for construction. Include in the discussion the difference between direct hire and indirect hire construction contracts, and the role of Department construction management and engineering personnel in the construction process.

1.19 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of the fundamentals and principles of hydraulics.

Supporting Knowledge and/or Skills

a. Define the following:

- Dynamic viscosity
- Kinematic viscosity
- Specific volume
- Specific gravity
- Capillarity
- Cavitation
- Hoop tension
- Laminar flow
- Turbulent flow
- Uniform flow

b. Discuss pressurized and non-pressurized flow.

c. Conduct a piping network analysis.

1.20 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of basic electrical equipment.

Supporting Knowledge and/or Skills

a. Discuss the basic purpose of a transformer.

b. Discuss the applications of alternating current (AC) and direct current (DC) generators and motors on a construction project.

c. Discuss application of the following as backup power supplies:

- UPS inverters
- Diesel generators
- Motor generators
- Auto transfer switches

d. Discuss the types and function of electrical switchgear used on a construction project.

e. Identify and discuss the application of the different types of circuit breakers.

1.21 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of basic electrical equipment operation.

Supporting Knowledge and/or Skills

a. Discuss the various types of batteries used in electrical systems. Include the following elements of battery operation in the discussion:

- Capacity
- Voltage applications
- Battery life expectancy
- Environmental requirements for safe battery operation

b. Discuss the basic operation of alternating current (AC) and direct current (DC) generators.

c. Discuss the basic operation of the various types of alternating current (AC) and direct current (DC) motors. Include in the discussion the following elements of motor operation as applicable to alternating current (AC) or direct current (DC) motors:

- Starting current vs. running current
- Current vs. load characteristics
- Applications for different types of motors

d. Discuss the basic operation of the various types of transformers. Include in the discussion the following elements of transformer operation and design:

- Theory of operation
- Purpose of the transformer
- Transformer ratings
- Transformer cooling requirements

e. Identify and discuss the operation of the different types of electrical switchgear.

1.22 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of instrumentation and control systems.

Supporting Knowledge and/or Skills

a. Describe the functions that temperature, pressure, level, flow, position, and radiation detectors provide.

b. Describe the basic operation of process control systems used in the following applications:

- Temperature measurement
- Flow measurement
- Pressure measurement
- Level measurement
- Position measurement

c. Discuss the requirements specific to instrumentation and control system components that are important to safety.

d. Describe the operation of the following types of actuators used in process control systems:

- Pneumatic
- Hydraulic
- Solenoid
- Electric motor

1.23 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of basic heat transfer and fluid flow concepts.

Supporting Knowledge and/or Skills

a. Explain the following terms:

- Static head
- Velocity head

- Friction head
- Head loss

b. Describe the relationship between pressure and flow in a process system.

c. Using the ideal gas law, discuss the relationship between pressure, temperature, and volume.

d. Describe the effects of pressure and temperature changes on confined fluids.

e. Describe how the density of a fluid varies with its temperature.

f. Define the terms "mass flow rate" and "volumetric flow rate."

1.24 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of the construction and operation of basic mechanical components.

Supporting Knowledge and/or Skills

a. Describe the function, construction, and operation of the following types of pumps:

- Centrifugal pump
- Positive displacement pump
- Single stage and multiple stage pumps
- Submersible pumps

b. Describe the basic construction and operation of the following types of valves:

- Gate valve
- Globe valve
- Butterfly valve
- Check valve
- Relief and safety valves

c. Discuss the function and application of the following types of filters/strainers used in mechanical fluid flow systems and ventilation systems:

- Cartridge filters
- Precoated filters
- Bucket strainers
- Deep-bed filters
- HEPA filters
- Particulate filters
- Duplex strainers

d. Discuss the causes of water hammer and pressure spiking.

e. Describe the operation of a compressed air system, including a discussion of the basic function of each of the following components:

- Compressor
- Moisture separator
- Intercooler
- After cooler
- Receiver
- Air dryer

f. Describe the basic operation of pressure regulating, temperature control, and flow control valves in a process system.

g. Describe the basic operation of a heat exchanger used in a process system.

h. Describe the basic design and operation of a typical heating, ventilation, and air conditioning (HVAC) system.

1.25 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of mechanical system/component installation.

Supporting Knowledge and/or Skills

a. Discuss the following elements and components of mechanical system piping design. Include a discussion of construction methods used in the installation of each component:

- Pipe hangers
- Piping supports
- Snubbers
- Piping insulation and vapor barriers
- Piping installation
- Piping anchors
- Piping material
- Field routing of piping
- Expansion joints

b. Discuss the following types of piping connections and their application to different piping sizes and uses:

- Threaded connections
- Flanged connections
- Socket welded connections
- Butt welded connections
- Reweldable joints
- Bayonet joints
- Compression joints

c. Describe the basic construction methods and precautions associated with the installation of the following types of mechanical components:

- Large pumps
- Heat exchangers
- Air conditioning units
- Compressors
- Tanks and pressure vessels

1.26 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of computer applications used in construction management.

Supporting Knowledge and/or Skills

a. Describe the project scheduling system used to track and report project status.

b. Read and interpret computer generated project reports.

c. Describe the applications of computer aided design (CAD) and computer aided engineering (CAE) tools.

d. Describe the use of computers in the scheduling of construction projects, including a discussion of what the computer applications can do for the Construction Manager as well as what they cannot do.

e. Describe how the project schedule is used to control cost and schedule as well as track it.

1.27 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of the systems for industrial waste treatment, storm drains, and sanitary waste treatment .

Supporting Knowledge and/or Skills

a. Describe the basic design for a sanitary waste treatment system.

b. Discuss the following methods of waste water treatment:

- Primary
- Secondary
- Tertiary

c. Discuss the functions of the following components:

- Clarifier
- Trickling filters

- Pumping station
- Wet well

d. Discuss the methods and requirements for solid waste disposal associated with sanitary waste treatment systems.

e. Discuss the construction and installation requirements for sewers and force mains.

f. Discuss the installation and construction requirements for storm drain and sewer main piping that pass under a security barrier.

g. Discuss the hydraulics associated with the following:

- Runoff into storm sewers
- Open channels
- Street drainage

2. REGULATORY

NOTE: When Department of Energy (DOE) directives are referenced in the qualification standard, the most recent revision should be used.

2.1 Construction management and engineering personnel shall demonstrate the ability to evaluate contractor compliance with Department of Energy (DOE) Order 6430.1A, General Design Criteria.

a. Discuss the use of the General Design Criteria in the identification of construction design requirements at defense nuclear facilities

b. Discuss the purpose, scope and application of the construction requirements detailed in the General Design Criteria.

c. Discuss what constitutes acceptable contractor performance in the General Design Criteria.

d. Discuss the relationship between industry construction standards and the General Design Criteria.

e. Using the design package for a system, civil or structural application, determine the design criteria requirements for the system, components or structure.

f. Discuss what constitutes a safety-class item as defined in the General Design Criteria.

g. Evaluate local compliance with the following construction site preparation criteria in the General Design Criteria.

- Site development
- Surveying
- Site preparation
- Earthwork

h. Evaluate local compliance with the following construction project structural criteria in the General Design Criteria.

- Shoring and underpinning
- Building foundations
- Concrete
- Structural steel
- Wood structures
- Thermal and moisture protection

i. Evaluate local compliance with the criteria in the General Design Criteria related to the proper handling, site storage, and installation of mechanical and electrical equipment.

2.2 Construction management and engineering personnel shall demonstrate a working level knowledge of Department of Energy (DOE) Order 4700.1, Project Management System, as it applies to Department of Energy construction projects.

Supporting Knowledge and/or Skills

a. Discuss the purpose, scope, and application of DOE Order 4700.1, Project Management System. Include in this discussion the key terms, essential elements, and personnel responsibilities and authorities.

b. Discuss the project management terminology for which definitions are provided in DOE Order 4700.1, Project Management System.

c. Discuss the responsibilities of the following positions in the management of a construction project:

- Contracting officer
- Project manager
- Construction engineer
- Architect-engineer
- Construction contractor
- Construction manager
- Operating contractor

d. Discuss the purpose of "critical decisions." Include in the discussion the responsible authorities for critical decisions.

e. Support the preparation of a project execution plan for a construction project using the guidance provided in DOE Order 4700.1, Project Management System.

f. Discuss the requirements that must be met to make a change to a project execution plan.

g. Discuss the following types of cost estimates used during the life of a construction project:

- Planning estimate
- Budget estimate
- Title I design estimates
- Title II design estimates
- Government estimates
- Current working estimates
- Independent cost estimates

h. Discuss the purpose and application of the Project Authorization System to construction projects.

i. Describe the aids used to control construction activities.

j. Discuss the documents that should be maintained in the construction project record.

k. Discuss the content, requirements, and application of Title I and Title II Design Summaries to construction projects.

l. Discuss the graded approach to each of the following elements of project baseline development:

- Technical baseline and work scope development
- Roles and responsibilities
- Cost estimating
- Planning and scheduling baseline
- Cost baseline

2.3 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of the following laws and Department of Energy Order related to environmental protection, safety and health:

- **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)**
- **Resource Conservation and Recovery Act (RCRA)**
- **National Environmental Policy Act (NEPA)**
- **Clean Water Act (CWA)**
- **Clean Air Act (CAA)**
- **Toxic Substances Control Act (TSCA)**
- **DOE Order 5480.4, Environmental Protection, Safety, and Health Protection Standards**

Supporting Knowledge and/or Skills

a. Discuss the purpose, scope, and application of the listed Acts and DOE Order. Include in this discussion the key terms, essential elements, and personnel responsibilities and authorities.

b. Discuss the contractor's responsibilities for environmental safety and health protection, as stated in the above documents.

c. Given the results from an analysis of contractor noncompliance with the environmental safety and health protection requirements of the listed documents, determine the potential implications and describe the procedure for communicating the results to the contractor and to Department management.

d. Discuss the application of the listed environmental protection Acts to a construction project during the conceptual, execution, acceptance, and close-out phases of the project.

2.4 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of the quality assurance processes and procedures applicable to construction management in Department of Energy (DOE) Order 5700.6C, Quality Assurance, and 10 CFR 830.120, Quality Assurance Requirements.

Supporting Knowledge and/or Skills

a. Discuss the purpose, scope, and application of DOE Order 5700.6C. Include in this discussion key terms, essential elements, and personnel responsibilities and authorities.

b. Discuss the purpose, scope, and application of 10 CFR 830.120. Include in this discussion key terms, essential elements, and personnel responsibilities and authorities.

c. Discuss the quality assurance measures required for each of the following elements of a project:

- Design control
- Procurement control
- Instructions, procedures, and drawings
- Document control
- Identification, control, and traceability of materials, parts, and components
- Control of special processes
- Inspection
- Test control
- Calibration and control of test and measurement equipment
- Handling, storage, shipping, and preservation of material, parts, or components
- Nonconformity of material, parts, or components
- Corrective action
- Quality assurance records
- Audits

d. Describe the screening process for the identification and inspection of suspect or counterfeit material items.

e. Describe the roles and responsibilities of Department of Energy quality assurance personnel and construction personnel for quality control during construction activities.

2.5 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of the following Department of Energy Technical Standards and Order related to natural phenomena hazards:

- **DOE-STD-1020-94, Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities**
- **DOE-STD-1021-93, Natural Phenomena Hazards Performance Categorization Guidelines for Structures, Systems, and Components**
- **DOE-STD-1022-94, Natural Phenomena Hazards Site Characterization Criteria**
- **DOE Order 5480.28, Natural Phenomena Hazards Mitigation**

Supporting Knowledge and/or Skills

a. Describe the purpose, scope, and application of the requirements detailed in the listed Technical Standards and Order.

b. Discuss the graded approach process that Department line management uses to determine an appropriate level of coverage by construction managers. Include in this discussion the factors that may influence the level of coverage.

c. Determine contractor compliance with the documents listed above as they apply to contract design requirements and construction activities of a construction project at a defense nuclear facility.

2.6 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of the safety evaluation process and Department of Energy (DOE) Order 5480.21, Unreviewed Safety Questions.

Supporting Knowledge and/or Skills

a. Discuss the reasons for performing an Unreviewed Safety Question determination.

b. Define the following terms:

- Accident Analysis
- Safety Evaluation
- Technical Safety Requirements

c. Describe the situations for which a safety evaluation is required to be performed.

d. Define the conditions for an Unreviewed Safety Question.

e. Describe the actions to be taken by a contractor upon identifying information indicating potential inadequacy of previous safety analyses or a possible reduction in the margin of safety as defined in the Technical Safety Requirements.

2.7 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of the Technical Safety Requirements as described in Department of Energy (DOE) Order 5480.22, Technical Safety Requirements.

Supporting Knowledge and/or Skills

a. Discuss the purpose of the Technical Safety Requirements.

b. Describe the responsibilities of contractors authorized to operate defense nuclear facilities regarding the Technical Safety Requirements.

c. Define the following terms and discuss the purpose of each:

- Safety Limit
- Limiting Control Settings
- Limiting Conditions for Operation
- Surveillance Requirements

d. Describe the general content of each of the following sections of the Technical Safety Requirements:

- Use and Application
- Safety Limits
- Operating Limits
- Surveillance Requirements
- Administrative Controls
- Basis
- Design Features

2.8 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of reports as described in Department of Energy (DOE) Order 5480.23, Nuclear Safety Analysis Reports.

Supporting Knowledge and/or Skills

a. Discuss the four basic purposes and objectives of Nuclear Safety Analysis Reports.

b. Describe the responsibilities of contractors authorized to operate defense nuclear facilities in developing and maintaining a Nuclear Safety Analysis Report.

c. Define the following terms and discuss the purpose of each:

- Design basis
- Authorization basis
- Engineer safety features
- Safety analysis

d. Discuss the general content of each of the required sections of this report.

e. Discuss the uses that contractor management makes of Nuclear Safety Analysis Reports.

f. Discuss the relationship between the construction schedule and the development or modification of the facility Nuclear Safety Analysis Report.

2.9 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of the Occupational Safety and Health Act (OSHA) requirements in the following chapters of the Code of Federal Regulations:

- **29 CFR 1910, Occupational Safety and Health Standards**
- **29 CFR 1926, Safety and Health Regulations for Construction**

Supporting Knowledge and/or Skills

a. Discuss how the Occupational Safety and Health Act applies to and impacts Department construction projects.

b. Identify the requirements in the Occupational Safety and Health Act that form the basis of authority for construction management personnel in the oversight and management of construction projects.

c. Discuss the basic requirements in the listed documents for each of the following areas associated with construction projects:

- Personnel protective equipment (PPE)
- Electrical safety
- Safety hazards associated with welding
- Safety hazards associated with materials handling and storage
- Safety hazards associated with machinery
- Safety hazards associated with portable and hand tools
- Safety hazards associated with concrete and masonry
- Safety hazards associated with scaffolding

d. Discuss the responsibilities of the construction manager in ensuring compliance with Occupational Safety and Health Act requirements.

e. Describe the actions to be taken to correct a deficiency with the requirements of the listed documents.

f. Develop an assessment plan for inspection of construction activities and the construction site for compliance with Occupational Safety and Health Act requirements.

2.10 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of National Fire Protection Association (NFPA) industry standards for construction management and engineering.

Supporting Knowledge and/or Skills

a. Discuss the purpose, scope, and application of the National Fire Protection Association industry standards. Include in this discussion key terms, essential elements, and personnel responsibilities and authorities.

b. During the actual management of a construction project, identify the National Fire Protection Association industry standards necessary to evaluate the appropriate elements of the project.

2.11 Construction management and engineering personnel shall demonstrate a working level knowledge of the Uniform Building Code (UBC) industry standards for construction management and engineering.

Supporting Knowledge and/or Skills

a. Discuss the purpose, scope, and application of the Uniform Building Code industry standards. Include in this discussion key terms, essential elements, and personnel responsibilities and authorities.

b. During the actual management of a construction project, identify the Uniform Building Code industry standards necessary to evaluate the appropriate elements of the project.

c. Determine contractor compliance with the requirements of the Uniform Building Code industry standards as they apply to contract design requirements and construction activities at a defense nuclear facility.

2.12 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of the Prestressed Concrete Institute (PCI) industry standards for construction management and engineering.

Supporting Knowledge and/or Skills

a. Discuss the purpose, scope, and application of the Prestressed Concrete Institute industry standards. Include in this discussion key terms, essential elements, and personnel responsibilities and authorities.

b. During the actual management of a construction project, identify the Prestressed Concrete Institute industry standards necessary to evaluate the appropriate elements of the project.

2.13 Construction management and engineering personnel shall demonstrate a working level knowledge of construction methods and accepted construction practices associated with reinforced concrete design as described in the following American Concrete Institute (ACI) documents:

- **ACI-318, Building Code Requirements for Reinforced Concrete**
- **ACI-349, Code Requirements for Nuclear Safety Related Concrete Structures**
- **ACI-311.4R, Guide for Concrete Inspection**
- **ACI-311.5R, Batch Plant Inspection and Field Testing of Ready-Mixed Concrete**
- **ACI-305R, Hot Weather Concreting**
- **ACI-306R, Cold Weather Concreting**

Supporting Knowledge and/or Skills

a. Discuss the standard construction methods for plain, reinforced, or prestressed concrete structures. Include a discussion of the concrete materials, design, and construction of the following:

   - Sanitary engineering structures
   - Concrete forms
   - Concrete reinforcement
   - Cast-in-place concrete
   - Pre-cast concrete
   - Cementitious decks for buildings
   - Mass concrete
   - Post tension concrete
   - Tilt-up concrete

b. Discuss the construction climatic considerations for hot and cold weather concreting including the code requirements in ACI-305R and ACI-306R.

c. Identify and discuss the minimum building code requirements for reinforced concrete in ACI-318.

d. Identify and discuss the requirements for concrete construction in ACI-349.

e. Discuss the longitudinal and shear reinforcement requirements for beam design.

f. Describe the inspection methods used for concrete.

2.14 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of welding, weld testing and inspection, and the criteria in the following American Welding Society (AWS) codes:

- **AWS D1.1, Structural Welding Code - Steel**
- **AWS D1.2, Structural Welding Code - Aluminum**
- **AWS D1.3, Structural Welding Code - Sheet Steel**
- **AWS D5.2, Standard for Welded Steel, Elevated Tanks, Standpipes, and Reservoirs for Water Storage**

Supporting Knowledge and/or Skills

a. Describe the welding techniques, materials, and equipment used for different metals and applications.

b. Describe the welding techniques, materials, and equipment used for nonmetals.

c. Discuss the requirements for welder qualification and the methods for ensuring that qualifications are current.

d. Describe the techniques and requirements for destructive testing of welds.

f. Discuss the following methods of weld inspection:

- Visual
- Radiographing
- Dye penetrant
- Ultrasonic

2.15 Construction management and engineering personnel shall demonstrate a working level knowledge of construction methods and accepted construction practices associated with structural steel as described in the following documents:

- **American Institute of Steel Construction AISC-M011 , Manual of Steel Construction**
- **American Institute of Steel Construction AISC-N690, Nuclear Facilities: Steel Safety-Related Structures for Design, Fabrication, and Erection**
- **American Institute of Steel Construction AISC-S326, Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings**
- **Uniform Building Code (UBC)**

Supporting Knowledge and/or Skills

a. Discuss the structural design requirements and standard construction methods associated with the following:

- Light gauge steel
- Pre-engineered metal buildings
- Steel water tanks
- Transmission towers
- Steel joists
- Steel decks
- Structural steel connections and fastening

b. Define the following:

- Minimum edge distance
- Unbraced length
- Beam bearing plate
- Web crippling

c. Given data and the appropriate equations, calculate the following for a steel member:

- Average shear stress
- Parabolic shear stress
- Bending stress
- Axial stress
- Torsional shear stress

d. List the causes of buckling of load bearing columns and beams.

e. Describe the following types of connections:

- Friction
- Bearing
- Tension
- Rigid
- Non-rigid
- Semi-rigid

f. Evaluate scaffolding and temporary work platform arrangements for structural integrity and stability.

2.16 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of electrical equipment installation methods and National Electrical Code (NEC) requirements.

Supporting Knowledge and/or Skills

a. Discuss the classification of electric cable.

b. Determine the requirements in the National Electrical Code (NEC) for the installation of electrical equipment under a given set of conditions.

c. Describe the construction methods, equipment, and components used to install electrical distribution systems.

2.17 Construction management and engineering personnel shall demonstrate a working level knowledge of Department of Energy (DOE) Order 5480.9A, Construction Project Safety and Health Management.

Supporting Knowledge and/or Skills

a. Discuss the project manager/construction manager responsibilities set forth in DOE Order 5480.9A, Construction Project Safety and Health Management.

b. Discuss the construction contractor's responsibilities under DOE Order 5480.9A, Construction Project Safety and Health Management, for each of the following:

- Establishing a safety program
- Worksite presence during work activities
- Compliance by subcontractors

c. Discuss the requirements for the performance of a Preliminary Hazard Analysis (PHA) and an Activity Hazard Analysis (AHA). Include in the discussion each of the following elements:

- Responsibility for the performance of these analyses
- Purpose and content of the analyses
- When the analyses are required to be performed

d. Discuss the contractor's responsibility for providing necessary training for employees in the area of safety and health on the worksite.

e. Discuss the construction manager's responsibility for on-site safety and health inspections.

f. Discuss the contractor's required response to an identified safety or health hazard.

3. ADMINISTRATIVE

NOTE: When Department of Energy (DOE) directives are referenced in the qualification standard, the most recent revision should be used.

3.1 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of the requirements and methods of communicating with Department of Energy (DOE) Headquarters, Field elements, and regulatory agencies.

Supporting Knowledge and/or Skills

a. Describe the line organization chain from the Secretary of Energy to construction management and engineering personnel.

b. Describe the Department's organization and discuss the Department's procedures for communicating between Headquarters and Field elements.

c. Describe the Department's procedures and policy for communicating between the different elements of the Department of Energy and other regulatory agencies.

3.2 Construction management and engineering personnel shall demonstrate a familiarity level knowledge of record keeping requirements specified by the following Department of Energy (DOE) Orders:

- **DOE Order 4700.1, Project Management System.**
- **DOE Order 5000.3B, Occurrence Reporting and Processing of Operations Information.**

Supporting Knowledge and/or Skills

a. Discuss the documentation and reporting requirements for each of the following project status reviews:

   - Headquarters Reviews
   - Project Reviews
   - Field Reviews

b. Prepare and submit the required quarterly, supplemental, and annual reports for a construction project.

c. Discuss the requirements for project managers' progress reports for construction projects.

d. Describe the type of information contained in the Occurrence Reporting and Processing System (ORPS). Include how the data is used by construction management and engineering personnel.

4. MANAGEMENT, ASSESSMENT, AND OVERSIGHT

NOTE: When Department of Energy (DOE) directives are referenced in the qualification standard, the most recent revision should be used.

4.1 Construction management and engineering personnel shall demonstrate a working level knowledge of project management principles and the methods used to ensure that contractor resources are applied to meet quality, safety, technical, cost, and schedule commitments.

Supporting Knowledge and/or Skills

a. Explain the purpose of project management, and describe the life cycle of a typical project.

b. Describe the primary roles and responsibilities of construction management and engineering personnel as outlined in DOE Order 4700.1, Project Management System.

c. Describe typical documents and data sources used in Project Management.

d. Identify, explain, and discuss the relationship of the major elements of a project.

e. Explain the purpose and use of a Project Execution Plan.

f. Discuss the five elements of the Department of Energy program for operational configuration management as described in DOE-STD-1073-93, Guide for Operational Configuration Management Program.

- Design requirements
- Document control
- Program management
- Change control
- Assessments

g. Explain the use of safety plans in the management of projects.

h. Discuss the relationship between work breakdown structure (WBS) and cost and schedule.

i. Describe the purpose and use of work packages and/or planning packages.

j. Describe the purpose of schedules, and discuss the use of milestones and activities.

k. Describe the critical path method of scheduling.

l. Explain the concept of a project management baseline and describe the baseline used in project management.

m. Discuss the following elements of construction project contract labor:

- Availability of labor skills
- Interaction of labor crafts
- Standby requirements and their impact on the schedule
- Craft jurisdiction
- Union vs. non-union
- Skills and labor rates

n. Describe how performance and productivity rates are established.

o. Discuss the use of a resource loaded, time based, CPM schedule for the day-to-day control of a project and its importance in meeting cost and schedule baseline.

4.2 Construction management and engineering personnel shall demonstrate the ability to apply construction management principles in the execution of construction methods, constructibility reviews, planning, and performance measurement for a construction project.

Supporting Knowledge and/or Skills

a. Determine whether a construction project execution plan can be implemented safely and cost-effectively and still meet the project specifications.

b. Determine the availability of the resources, equipment, and qualified subcontractors necessary to implement a construction project execution plan.

c. Evaluate a contractor decision to make or buy.

d. Evaluate construction project execution plans and schedules for feasibility.

e. Manage contingency funding.

f. Prepare a Project Status Report and determine deviations from the estimates.

4.3 Construction management and engineering personnel shall demonstrate the ability to apply principles of risk management in preparing a risk assessment for a construction project.

Supporting Knowledge and/or Skills

a. Assess construction project risks that identify critical systems, subsystems, and other factors that require focused work and resolution.

b. Evaluate the assessed level of risk for a construction project.

c. Describe the basis for a risk assessment.

d. Identify the critical construction project elements that contribute to the risk.

e. Identify the consequences of the risk.

f. Develop activities and alternatives to minimize the risk.

g. Identify the stage of the construction project in which the risk exists.

4.4 Construction management and engineering personnel shall demonstrate the ability to perform project management duties in providing construction management and engineering support to a project.

Supporting Knowledge and/or Skills

a. Ensure that cost, schedule, and scope requirements are met.

b. Act as principal contact and liaison for the exchange of information between the contractor and the Department.

c. Ensure that instructions to the contractor are within the terms of the contract.

d. Ensure compliance by the contractor with the technical, safety, and administrative requirements of the contract.

e. Participate in the formulation and approval of plans and schedules.

f. Arrange for contacts between the construction contractor, other participants, and appropriate staff as required.

4.5 Construction management and engineering personnel shall demonstrate a working level knowledge of assessment techniques, reporting, and follow-up actions used to evaluate contractor performance.

Supporting Knowledge and/or Skills

a. Describe the role of construction management and engineering personnel in overseeing Government-Owned Contractor-Operated (GOCO) facilities.

b. Describe the assessment requirements and limitations of construction management and engineering personnel in interfacing with contractor employees.

c. Describe how planning, observing, interviewing, and document research are used during an assessment.

d. Explain the essential elements of a performance-based assessment including the areas of investigation, fact-finding, and reporting. Include a discussion of the essential elements and processes associated with the following assessment activities:

- Exit interviews

- Closure process
- Tracking to closure
- Follow-up
- Contractor corrective action implementation

e. Describe the actions to be taken if the contractor challenges the assessment findings. Explain how such challenges can be avoided.

4.6 Construction management and engineering personnel shall demonstrate the ability to assess contractor and/or Federal construction management and engineering activities and make all necessary reports.

Supporting Knowledge and/or Skills

a. Given different sets of performance data, compare and contrast the data to highlight acceptable and unacceptable work performance.

b. Describe the methods by which noncompliance is determined and communicated to contractor and Department of Energy management.

c. Conduct an assessment of a contractor's construction management and engineering activities and develop and submit the resulting assessment report.

d. Perform an independent assessment of contractor operations.

e. Conduct an interview representative of one that would be conducted during an occurrence investigation.

f. Develop an assessment report using the findings from an assessment.

g. Discuss the results of construction management and engineering assessments in a formal meeting between Department of Energy management and senior contractor management.

4.7 Construction management and engineering personnel shall demonstrate a working level knowledge of problem analysis principles and the techniques necessary to identify problems, determine potential causes of problems, and identify corrective action(s).

Supporting Knowledge and/or Skills

a. Compare and contrast immediate, short term, and long term actions taken as a result of problem identification or an occurrence.

b. Given event and/or occurrence data, apply problem analysis techniques and identify the problems and how they could have been avoided.

c. Describe various data gathering techniques and the use of trending/history when analyzing problems.

d. Interpret a fault tree analysis.

e. Participate in a contractor or Department of Energy problem analysis and critique the results.

4.8 Construction management and engineering personnel shall demonstrate the ability to interact with Federal, state, local, and public stakeholder representatives.

Supporting Knowledge and/or Skills

a. Discuss the roles and responsibilities of site and/or community advisory boards on construction management and engineering issues.

b. Discuss the Department of Energy's position on construction management and engineering issues that impact Federal, state, local, and public stakeholder segments.

c. Discuss the Freedom of Information Act and its impact on Department of Energy construction management and engineering programs. Discuss security precautions to be taken in relevant programs in terms of the Freedom of Information Act.

d. Communicate effectively with the public and other stakeholders.

e. Given construction management and engineering related program data, identify those portions of the data required to be communicated to organizations external to the Department of Energy construction management and engineering personnel. Discuss any potential impacts on Department of Energy programs.

f. Communicate with Headquarters Program Office representatives, Department of Energy Legal representatives, contractors, state, and local officials.

4.9 Construction management and engineering personnel shall demonstrate the ability to define and ensure effective implementation of required quality assurance activities for a construction project.

Supporting Knowledge and/or Skills

a. Describe the quality assurance program for a construction project.

b. Participate in material and test evaluations to validate that material specification requirements have been met.

c. Participate in source supply certification of mills, quarries, labs, batch plants, and weld shops.

d. Gather trending data and trace actions to correct recurring deficiency problems.

e. Evaluate the contractor's quality assurance plan.

f. Monitor quality assurance activities in the field and measure them against the quality assurance plan.

g. Participate in quality assurance plan surveillance.

EVALUATION REQUIREMENTS

The following requirements shall be met to complete the Department-wide Construction Management and Engineering Functional Area Qualification Standard. The evaluation process identified below serves as a measurement tool for assessing whether the participants have acquired the technical competencies outlined in this Standard.

1. Documented completion of the Department-wide General Technical Base Qualification Standard in accordance with the requirements contained in that standard.

2. Documented completion of the competencies listed in this functional area qualification standard. Documentation of the successful completion of these competency requirements may be satisfied by a qualifying official using any of the following methods:

   - Documented evaluation of equivalencies
   - Written examination
   - Documented oral evaluation
   - Documented observation of performance

CONTINUING TRAINING AND PROFICIENCY REQUIREMENTS

Construction management and engineering personnel shall participate in an Office/facility/position-specific continuing training and qualification program that includes the following elements:

1. Technical education and/or training covering topics directly related to the duties and responsibilities of construction management and engineering personnel as determined by line management. This may include courses and/or training provided by:

   - Department of Energy
   - Other Government agencies
   - Outside vendors
   - Educational institutions

2. Training covering topics that address identified deficiencies in the knowledge and/or skills of construction management and engineering personnel.

3. Training in areas added to the Construction Management and Engineering Functional Area Qualification Standard since initial qualification.

4. Specific continuing training requirements shall be documented in Individual Development Plans (IDPs).